Exercises

4.33 Use Definition 4.3 on page 120 to find the variance of the random variable X of Exercise 4.7 on page 117.

4.34 Let X be a random variable with the following probability distribution:

x	-2	3	5
$f(x)$	0.3	0.2	0.5

Find the standard deviation of X.

4.35 The random variable X, representing the number of errors per 100 lines of software code, has the following probability distribution:

x	2	3	4	5	6
$f(x)$	0.01	0.25	0.4	0.3	0.04

Using Theorem 4.2 on page 121, find the variance of X.

4.36 Suppose that the probabilities are 0.4, 0.3, 0.2, and 0.1, respectively, that 0, 1, 2, or 3 power failures will strike a certain subdivision in any given year. Find the mean and variance of the random variable X representing the number of power failures striking this subdivision.

4.37 A dealer's profit, in units of \$5000, on a new automobile is a random variable X having the density function given in Exercise 4.12 on page 117. Find the variance of X.

4.38 The proportion of people who respond to a certain mail-order solicitation is a random variable X having the density function given in Exercise 4.14 on page 117. Find the variance of X.

4.39 The total number of hours, in units of 100 hours, that a family runs a vacuum cleaner over a period of one year is a random variable X having the density function given in Exercise 4.13 on page 117. Find the variance of X.

4.40 Referring to Exercise 4.14 on page 117, find $\sigma^2_{g(X)}$ for the function $g(X) = 3X^2 + 4$.

4.41 Find the standard deviation of the random variable $g(X) = (2X + 1)^2$ in Exercise 4.17 on page 118.

4.42 Using the results of Exercise 4.21 on page 118, find the variance of $g(X) = X^2$, where X is a random variable having the density function given in Exercise 4.12 on page 117.

4.43 The length of time, in minutes, for an airplane to obtain clearance for takeoff at a certain airport is a random variable $Y = 3X - 2$, where X has the density function

$$f(x) = \begin{cases} \frac{1}{4}e^{-x/4}, & x > 0 \\ 0, & \text{elsewhere.} \end{cases}$$

Find the mean and variance of the random variable Y.

4.44 Find the covariance of the random variables X and Y of Exercise 3.39 on page 105.

4.45 Find the covariance of the random variables X and Y of Exercise 3.49 on page 106.

4.46 Find the covariance of the random variables X and Y of Exercise 3.44 on page 105.

4.47 For the random variables X and Y whose joint density function is given in Exercise 3.40 on page 105, find the covariance.

4.48 Given a random variable X, with standard deviation σ_X, and a random variable $Y = a + bX$, show that if $b < 0$, the correlation coefficient $\rho_{XY} = -1$, and if $b > 0$, $\rho_{XY} = 1$.

4.49 Consider the situation in Exercise 4.32 on page 119. The distribution of the number of imperfections per 10 meters of synthetic failure is given by

x	0	1	2	3	4
$f(x)$	0.41	0.37	0.16	0.05	0.01

Find the variance and standard deviation of the number of imperfections.

4.50 For a laboratory assignment, if the equipment is working, the density function of the observed outcome X is

$$f(x) = \begin{cases} 2(1 - x), & 0 < x < 1, \\ 0, & \text{otherwise.} \end{cases}$$

Find the variance and standard deviation of X.

4.51 For the random variables X and Y in Exercise 3.39 on page 105, determine the correlation coefficient between X and Y.

4.52 Random variables X and Y follow a joint distribution

$$f(x, y) = \begin{cases} 2, & 0 < x \le y < 1, \\ 0, & \text{otherwise.} \end{cases}$$

Determine the correlation coefficient between X and Y.